WEATHER, FORECASTS, AND WARNINGS FOR THE MONTH.

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Except on the Maine coast and in the neighborhood of San Luis Obisbo, Cal., the month was unusually cold in the United States and over a great portion of the interior of the country it was one of the coldest Decembers in the history of the Weather Bureau. The greatest deficiency in temperature occurred from the Ohio Valley westward to the middle Plateau, where the means for the month ranged from 5° to 12° below the normal. At points in the middle Rocky Mountain region minimum readings were as low or lower than previously recorded for December. Freezing temperatures were experienced over practically the entire South, parts of Florida, Texas, and the California coast being the only portions that were not visited by frost. In central and northern districts, from the Appalachian to the Rocky Mountains, minimum temperatures ranged from −3° to −20°, or lower, and in the higher levels of the Rockies temperatures of −30° to −47° were reported.

The month opened warm, but a cold wave that appeared on the 3d carried the means for the first decade 15° to 25° below the normal in the Great Plains and Rocky Mountain States. The means of the second decade were 3° to 15° below the normal, except on the extreme northeast and southeast coasts. During the closing days of the month there was a change to warmer weather, except in the Southeast, where the month ended with unusually low temperatures.

The precipitation of the month was deficient generally east of the Mississippi, marked excesses in this region being noted only from Maryland to southern New England, where rains and snows were comparatively heavy, and on the middle Gulf coast, where the excess was 2 to 4 inches. From the Mississippi westward to the Pacific precipitation was in excess in the southern Rocky Mountain district and Texas and from Montana over the North Pacific States. Over central and southern portions of California precipitation was heavy. From the middle and northern Rockies to the Lake region and along the Atlantic coast from northern Virginia to southern New England snowfall was unusually heavy. The snowfall in the Middle Atlantic States and southern New England attended a severe storm, elsewhere referred to, that moved over these districts during the 25th and 26th.

During the opening days of December destructive storms swept the British coasts and the North and Baltic seas. Over the western Atlantic Ocean a storm of varying intensity persisted until the evening of the 4th.

Over the North American Continent the month opened with high barometric pressure and low temperature over Alaska with a reported minimum temperature of −40° at Tanana. By the morning of the 3d the Alaskan high area had advanced over the British Northwest Territory and the northwestern portion of the United States attended by the first general cold wave of the season. On the morning of the 3d frost occurred in California, and on the following morning freezing temperatures were reported in the Great Valley of that State. Held back temporarily by an area of low barometer that covered the central valleys and Lake region the cold wave advanced over the Mississippi and Ohio valleys and the greater portion of the Lake region by the morning of the 8th, and on the morning of the 10th the line of freezing temperature extended into northern Florida. Owing to the persistence over the St. Lawrence Valley of a low area that had moved eastward from the Lake region the fall in temperature over the Middle Atlantic and New England States was not marked.

A disturbance that apparently advanced northeastward from the region of the Japan Sea during the last two days of November moved eastward over the Pacific to the United States coast by the 4th, and by the morning of the 6th an offshoot from this disturbance had passed southeastward over the southern Rocky Mountain districts. By the morning of the 7th this rapidly-moving depression had united with an area of low barometer, previously referred to, that had advanced over the central valleys from the Southwest. The passage of this low area was attended by heavy snow in portions of the Central West and Northwest and by destructive gales on the Great Lakes from the 5th to 8th, inclusive. From the 8th to 10th the center of disturbance passed eastward over the St. Lawrence Valley and Canadian Maritime Provinces and apparently moved thence southeastward toward the Azores, where the barometer fell to 29.54 inches on the 14th, to 29.08 on the 15th, and to 28.88 on the 16th. From the region of the Azores the disturbance moved northeastward to the west-central European coast by the 17th and reached the south coast of the North Sea on the 18th. Remaining nearly stationary over and near the North Sea until the 20th the storm passed thence over European Russia toward the White Sea and Arctic Ocean. It appears probable that this storm preserved its identity in a 3-weeks' course that carried it over the Pacific Ocean, the North American Continent, the Atlantic Ocean, and the Continent of Europe.

Over Siberia and the extreme British Northwest Territory barometric pressure continued high during the first decade of the month. On the 7th a reading of 31.18 inches was reported at Irkutsk, Siberia, and on the 6th a barometer reading of 31.28 inches was noted at Dawson, B. A., and a minimum temperature of −48° occurred at Eagle, Alaska.

From the 8th to 16th pressure was low over Alaska, and on the morning of the 9th a depression from that region occupied the north Pacific coast with pressure 29.22 inches at Tatoosh. Moving southeastward to the Mississippi Valley by the 12th this depression united with an extensive disturbance that had advanced from Alaska over the British Northwest. Moving eastward the united storms caused severe gales on the Great Lakes on the 13th and 14th that extended thence eastward over the middle Atlantic and New England coasts.

From the 4th to 12th gales were practically continuous on the north Pacific coast of the United States. Excessive rains on the 8th and 9th resulted in moderate floods in the Sacramento River, Cal. In the Gulf States rains occurred as each low area turned to the northeastward over that region. In the Atlantic States and lower Lake region there was no precipitation of consequence until the 7th. The storm of the 13th brought rains that ended a drought that had prevailed for several months in the Middle Atlantic States and North Carolina and from North Carolina over southern New England the rainfall ranged from 1 inch to more than 3 inches.

The morning of the 14th a pronounced high area appeared on the north Pacific coast south of the disturbance that had persisted over Alaska. The high area extended over the central valleys and the Southwest by the 17th and was followed by a moderate disturbance that appeared on the 15th over the Canadian Northwest and moved southeastward to the upper Lakes, where its identity was lost in a general low pressure area over Ontario on the 17th. Snow from this disturbance extended from the Lake region over Montana. An offshoot from a disturbance that appeared in the Southwest on the 16th reached the mouth of the Mississippi River on the morning of the 18th and passed off the southeast Florida coast on the 20th. The southern disturbances with high pressure to the northward caused general snows in the Rocky Mountain region and the Southwest and rain, sleet, and snow in the Gulf States. The rains and snows reached the South Atlantic States on the 18th and continued until the 20th.

From the 14th to 23d low temperature continued with brief

intermissions over the western half of the country with a minimum of −30° at Lander, Wyo., on the 18th. The cold wave extended over the Ohio Valley on the 17th and 18th, the Gulf States on the 18th, and the Atlantic States on the 19th and 20th. In the interior of the Gulf States there were 5 successive days of freezing temperature and on the middle Gulf coast and the interior of northern Florida freezing weather occurred on 3 consecutive days.

During this period of low temperature and high barometric pressure over the United States the barometer continued low over Alaska and an abnormal depression, previously referred to, persisted over the Azores region from the 13th to 17th and moved thence over Europe. Over Siberia pressure was variable until the 20th, when another high area appeared and continued until the 24th.

On the 19th another Pacific disturbance moved over California, attended by general rains in that State and by snow over the middle and southern Plateau districts. By the morning of the 21st the depression had moved to southwestern Arizona and snow was falling over the central Rocky Mountain region. Snow continued in that region until the 24th. On the latter date the center of the depression reached the Texas Panhandle and snow, sleet, and rain extended from the Southwest over the Mississippi and Missouri valleys. Increasing in intensity the disturbance moved rapidly over the Ohio Valley and the Middle Atlantic States and reached the New Jersey coast the evening of the 25th, with snow and rain over the entire eastern half of the country and heavy snow on the northern side of the storm's track. By the morning of the 26th the barometer was below 29.00 inches on the coast from New Jersey to Massachusetts and read 29.40 inches at Hamilton, Bermuda. High winds prevailed along the entire Atlantic coast and from New York City to Nantucket, Mass., severe gales were experienced. The winds moderated during the 26th but heavy snow continued over eastern New England. This was the severest storm of the month, and from Delaware northward high winds and heavy drifting snow caused a practical suspension of railway traffic. The greatest depth of snow, 22.8 inches, was reported at Philadelphia. At New York City the depth was 10.1 inches and at Boston, Mass., 12.3 inches of snow fell. Many small vessels were wrecked along the middle and north Atlantic coasts. An added feature of destruction was an exceptionally high tide on the New England coast on the 25th that rose 4 feet above normal high tide in Boston Harbor. The rise in barometer and fall in temperature following this storm were comparatively slight. Freezing temperatures again occurred, however, on the 26th in the Gulf and South Atlantic States.

By the evening of the 26th pressure was falling rapidly over the interior east of the Rocky Mountains and continued low until the evening of the 28th, with light snows in northern districts. Over districts west of the Rockies pressure was continuously high from the 23d to 29th, with fair weather and comparatively low temperature. An area of low barometer that appeared over Alberta the evening of the 28th moved southward, and on the 29th the Plateau high area began to lose strength.

On the morning of the 29th pressure was high over the Plains States and Mississippi Valley, a cold wave had extended into Tennessee, and winter temperatures prevailed throughout the country, except in Montana and on the Pacific coast. During the 30th the cold wave extended over the East and Southeast and carried the line of freezing temperature almost to the southern extremity of the Florida Peninsula.

On the 27th announcement was made that a storm would appear on the Pacific coast on the 31st. This storm advanced over the country during the first 5 days of January, preceded by a cold wave and attended by heavy precipitation in the form of rain, sleet, and snow.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	12	27.7	− 1.7	+ 3.9	+ 0.3
Middle Atlantic	15	31.2	− 3.8	+ 5.4	+ 0.4
South Atlantic	10	43.1	− 4.1	+ 8.5	+ 0.7
Florida Peninsula*	8	57.9	− 2.8	+14.5	+ 1.2
East Gulf	11	44.1	− 5.0	+16.0	+ 1.3
West Gulf	10	42.2	− 6.4	+19.5	+ 1.6
Ohio Valley and Tennessee	13	29.9	− 7.3	+ 4.3	+ 0.4
Lower Lakes	10	24.6	− 4.7	− 2.5	− 0.2
Upper Lakes	12	21.0	− 3.3	+ 7.5	+ 0.6
North Dakota*	9	4.8	− 8.0	− 4.3	− 0.4
Upper Mississippi Valley	14	19.1	− 8.2	+ 3.8	+ 0.1
Missouri Valley	12	17.2	− 9.7	+ 5.4	+ 0.4
Northern slope	9	13.8	− 9.9	− 6.5	− 0.5
Middle slope	6	23.0	−10.0	+ 3.7	+ 0.3
Southern slope*	7	35.6	− 6.6	+12.0	+ 1.0
Southern Plateau*	11	34.3	− 6.3	− 9.6	− 0.8
Middle Plateau*	10	18.3	− 9.4	− 3.8	− 0.3
Northern Plateau*	10	23.4	− 6.0	− 5.3	− 0.4
North Pacific	7	37.0	− 4.6	+14.3	+ 1.2
Middle Pacific	5	45.9	− 2.4	− 4.7	− 0.4
South Pacific	4	51.0	− 1.7	− 0.4	0.0

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		Inches.	Inches.
New England	11	2.53	76	− 0.8	− 3.2
Middle Atlantic	15	3.37	106	+ 0.2	− 3.2
South Atlantic	11	2.11	58	− 1.5	−11.6
Florida Peninsula*	8	1.98	74	− 0.7	− 4.8
East Gulf	11	5.23	88	− 0.7	+ 3.1
West Gulf	10	2.83	100	0.0	−12.2
Ohio Valley and Tennessee	13	3.06	88	− 0.4	+ 1.1
Lower Lakes	10	2.59	90	− 0.3	+ 0.7
Upper Lakes	12	2.93	138	+ 0.8	+ 0.1
North Dakota*	9	1.26	225	+ 0.7	+ 0.3
Upper Mississippi Valley	15	2.46	132	+ 0.6	+ 3.0
Missouri Valley	12	1.97	184	+ 0.9	+ 5.5
Northern slope	9	0.85	113	+ 0.1	+ 0.5
Middle slope	6	0.86	113	+ 0.1	+ 1.7
Southern slope*	7	0.57	49	− 0.6	− 7.8
Southern Plateau*	11	1.32	143	+ 0.4	+ 0.1
Middle Plateau*	11	1.75	167	+ 0.7	+ 2.0
Northern Plateau*	10	1.23	66	− 0.6	+ 0.6
North Pacific	7	4.66	59	− 3.3	− 0.8
Middle Pacific	7	5.02	114	+ 0.6	+ 6.6
South Pacific	4	6.34	296	+ 4.2	+ 9.8

*Regular Weather Bureau and selected cooperative stations.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	79	+ 3	Missouri Valley	84	+ 9
Middle Atlantic	70	− 5	Northern slope	83	+15
South Atlantic	71	− 7	Middle slope	79	+13
Florida Peninsula	80	− 1	Southern slope	73	+ 7
East Gulf	73	− 4	Southern Plateau	68	+22
West Gulf	72	− 2	Middle Plateau	83	+13
Ohio Valley and Tennessee	77	+ 1	Northern Plateau	82	+ 2
Lower Lakes	81	+ 3	North Pacific	86	0
Upper Lakes	85	+ 3	Middle Pacific	76	− 5
North Dakota	92	+13	South Pacific	70	+ 1
Upper Mississippi Valley	85	+ 7			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.7	− 0.4	Missouri Valley	6.0	+ 0.8
Middle Atlantic	5.2	− 0.6	Northern slope	6.0	+ 0.8
South Atlantic	4.1	− 0.8	Middle slope	4.6	+ 0.5
Florida Peninsula	4.5	− 0.2	Southern slope	4.8	− 0.2
East Gulf	5.0	− 0.5	Southern Plateau	4.6	+ 1.4
West Gulf	4.8	− 0.4	Middle Plateau	5.8	+ 1.0
Ohio Valley and Tennessee	6.7	− 0.4	Northern Plateau	8.0	+ 1.2
Lower Lakes	8.3	+ 0.6	North Pacific	7.0	− 0.8
Upper Lakes	8.1	+ 0.8	Middle Pacific	6.0	+ 0.6
North Dakota	6.9	+ 1.5	South Pacific	5.6	+ 1.3
Upper Mississippi Valley	7.0	+ 1.2			

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Atlanta, Ga.	25	50	w.	Nantucket, Mass.	26	61	e.
Do.	26	50	nw.	New York, N. Y.	25	56	ne.
Block Island, R. I.	23	50	nw.	Do.	26	58	ne.
Do.	26	72	ne.	North Head, Wash.	1	52	nw.
Buffalo, N. Y.	5	56	sw.	Do.	2	56	nw.
Do.	6	54	sw.	Do.	8	52	sw.
Do.	7	72	w.	Do.	9	64	se.
Do.	8	50	w.	Do.	11	72	se.
Do.	13	52	sw.	Do.	12	66	s.
Do.	14	60	sw.	Do.	29	50	s.
Burlington, Vt.	14	50	se.	Pensacola, Fla.	12	52	se.
Chicago, Ill.	5	52	sw.	Pittsburg, Pa.	7	69	w.
Cleveland, Ohio	5	51	s.	Point Reyes Light, Cal.	1	66	nw.
Detroit, Mich.	5	56	sw.	Do.	2	75	nw.
Do.	7	52	w.	Do.	4	78	s.
Eastport, Me.	14	66	e.	Do.	5	51	nw.
Do.	26	50	ne.	Do.	6	64	s.
Erie, Pa.	13	55	se.	Do.	8	66	s.
Grand Haven, Mich.	5	52	sw.	Do.	9	50	nw.
Grand Rapids, Mich.	5	52	sw.	Do.	31	52	nw.
Hatteras, N. C.	25	58	w.	Port Huron, Mich.	5	50	sw.
Do.	26	54	w.	Portland, Me.	14	54	se.
Modena, Utah	9	50	sw.	Savannah, Ga.	25	52	w.
Do.	31	51	s.	Sioux City, Iowa	16	50	nw.
Mount Tamalpais, Cal.	1	50	nw.	Southeast Farallon, Cal.	1	55	nw.
Do.	2	62	nw.	Do.	2	59	nw.
Do.	3	50	n.	Do.	4	62	sw.
Do.	6	54	se.	Do.	6	67	s.
Do.	8	52	sw.	Do.	8	52	s.
Do.	9	62	nw.	Tatoosh Island, Wash.	4	72	ne.
Mount Weather, Va.	7	63	nw.	Do.	6	86	e.
Do.	8	50	nw.	Do.	7	80	e.
Do.	22	56	nw.	Do.	8	64	e.
Do.	23	66	nw.	Do.	9	56	s.
Do.	26	73	nw.	Do.	10	53	sw.
Do.	29	64	nw.	Do.	11	50	s.
Do.	30	53	nw.	Topeka, Kans.	5	55	sw.
Nantucket, Mass.	14	50	se.				

RAINFALL IN JAMAICA.

Through the kindness of Mr. Maxwell Hall, meteorologist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following data:

Comparative table of rainfall.

[Based upon the average stations only.]

DECEMBER, 1909.

Divisions.	Relative area.	Number of stations.	Rainfall 1909.	Rainfall Average.
			Inches.	*Inches.*
Northeastern division	25	17	2.22	9.96
Northern division	22	41	2.59	5.88
West-central division	26	20	1.48	3.67
Southern division	27	26	0.62	2.74
Means	100		1.73	5.56

The rainfall over the island was remarkably small, being only one-third of the average. The greatest rainfall, 10.27 inches, was recorded at Green Vale, in Portland, and no rainfall occurred at several stations in the southern division.

General summary for the year 1909.

[From about 110 "average" stations.]

Month.	NE.	N.	W.-C.	S.	The island.
1909.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	8.78	4.08	2.07	2.50	4.35
February	2.75	0.77	1.76	1.24	1.63
March	3.83	2.36	3.76	1.52	2.87
April	4.19	1.47	5.03	3.88	3.64
May	6.15	5.75	11.31	4.13	6.84
June	4.98	5.22	9.46	6.01	6.42
July	4.78	3.40	8.44	5.45	5.52
August	8.60	6.15	10.78	7.03	8.14
September	15.18	12.70	19.45	16.50	15.96
October	13.13	7.88	14.08	12.32	11.85
November	38.07	13.66	14.24	18.92	21.22
December	2.22	2.59	1.48	0.62	1.73
Total	112.66	66.03	101.84	80.12	90.17

RIVERS AND FLOODS.

The principal floods of the month occurred in Oregon and Washington, reaching their height during the last week of November, but continuing during the first few days of December. Those in the Willamette watershed in the State of Oregon were caused by persistent heavy rains from November 17 to 24, inclusive, and were almost entirely rain floods, as there was but little snow in the mountains. There had, however, been frequent and substantial rains during the first half of the month, and these so saturated the soil that practically all of the succeeding rains ran into the rivers. These later rains from November 17 to 24, inclusive, averaged about 80 per cent of the normal amount for the entire month of November, and were sufficient in themselves to cause an ordinary flood. The first preliminary advices and warnings were issued on November 22, when the rise first set in, and were continued daily until November 29, when announcement was made that the Willamette River was falling at all points, and that the rain then falling would not be sufficient to check the fall. The warnings were very successful, the crest stages reached differing but slightly from those forecast. At Salem, Oreg., the crest stage on November 25 was 30.7 feet, 10.7 feet above the flood stage, and the highest recorded stage, the record extending back to the year 1891, while at Portland the crest stage of 22.3 feet on November 26 was 7.3 feet above the flood stage, and the highest November stage of record. The following table shows the crest stages at the different stations and the times of their occurrence.

This flood occurred at a time of year when there were no growing crops, and the losses and damage were consequently very much less than would have resulted at another season. Lowlands were flooded generally, but the sedimentary deposits were, as usual along rivers of this character, very beneficial to the lands. Some hops were watersoaked, a few bridges were carried away, and some mills were obliged to close, but it is doubtful whether the total losses from the flood amounted to more than $200,000. The data regarding this flood were furnished by Mr. H. J. Andree of the Local Office of the Weather Bureau at Portland, Oreg.

Station.	River.	Flood stage.	Highest stage.	Date.
Eugene	Willamette	10	21.5	Nov. 23, 12:00 noon.
Harrisburg	....do.	7	14.8	Nov. 23, 3:00 p. m.
Albany	....do.	20	31.0	Nov. 24, 3:00 p. m.
Jefferson	Santiam	10	17.0	Nov. 23, 8:00 a. m.
Salem	Willamette	20	30.7	Nov. 25, 5:00 a. m.
McMinnville	Yamhill	35	39.0	Nov. 24, 9:00 a. m.
Wilsonville	Willamette	37	39.5	Nov. 25, 8:00 a. m.
Tualitin	Tualitin	15	9.7	Nov. 25, 8:00 a. m.
Portland	Willamette	15	22.3	Nov. 26, 1:00 p. m.

In the State of Washington the floods occurred in the small, but swift flowing streams that head in the Olympic Mountains, the rivers on both sides of the Cascade Mountains, and the Chehalis and Willapa rivers that head in the coast range and flow directly into the Pacific Ocean. The floods were caused by a combination of the heaviest November rainfalls on record, and warm winds that melted the snow fields at the headwaters of the streams. The rainfall was almost continuous, except for a few days about the middle of the month, and all the rivers were in flood, some of them reaching stages higher than ever before recorded. No details were available for the rivers in the northwestern part of the State, but the cooperative observers of the Weather Bureau agreed in the general statement that the floods were the greatest that had